Initial Human Capital or the Rule of Law: What Matters for the Income Convergence of Poor Countries?

Faiza Azhar Khan[a] & John Hudson[a]

[a] Department of Economics,University of Bath, Claverton Down, Bath, BA27AY, UK

Abstract:

The paper analyzes conditional β-convergence among the low income countries using a panel data framework covering the period 1960-2008. The estimation of conditional income convergence is based on the augmented Solow model with system GMM technique for the dynamic panel data. More importantly, the paper assesses the role of initial human capital stock and the rule of law in the income convergence of poor countries by considering further categorizations of the poor countries based on these two variables. This is the first study on the comparative properties of human capital and the rule of law in the income convergence of poor countries utilizing a dynamic panel framework. The full sample of low income countries do not show any evidence of conditional income convergence. The categorizations on the basis of initial human capital stock do not alter the conclusion of no income convergence. However, the subsample of low income countries with a better rule of law exhibits positive evidence of convergence towards the steady states. The paper concludes that there exists a greater role of the rule of law, than initial human capital stock, in the income convergence of poor countries and vice versa for the high and middle income countries.

Keywords: initial human capital; rule of law; dynamic system GMM; augmented Solow model

JEL Classification: O47; O50

I. Introduction

The subject of *poor becoming the rich* or β-convergence has been discussed in the literature for quite a long period. The initial empirics were based on a simple concept of *absolute β-convergence*, entailing identical levels of per capita income for all the countries in the long-run (Baumol, 1986; Barro and Sala-i-Martin, 1990). However, the evidence of absolute divergence for the world countries resulted in the concept of *conditional β-convergence*, entailing the convergence of countries towards their respective steady states (Barro, 1991). Mankiw *et al*. (1992) derived the framework

of analysis for the conditional β-convergence based on the neo-classical growth model and have estimated it utilizing cross-country data. Following Mankiw *et al*. (1992), some studies on the conditional β-convergence have utilized the augmented Solow model of estimation using the cross-sectional data framework (Murthy and Ukpolo, 1999; Dobson and Ramlogan, 2002). However, a greater number of studies on conditional β-convergence for various groups of countries have utilized panel data techniques for the estimation of the augmented Solow model (Islam, 1995; Caselli *et al*., 1996; Bond *et al*., 2001).

Another notable development in the growth and convergence empirics has been the inclusion of additional regressors in the economic/income growth models [Barro (1991)] to proxy long-run income. Such growth regressions also, known as Barro style growth regressions, have been an important part of the convergence literature (Sala-i-Martin, 1996; Barro, 2003). As far as additional regressors are concerned, many socio-economic, demographic and policy variables have been considered for these regressions. The initial level of human capital, rule of law, government consumption, fertility rate and trade openness are some of the explanatory variables in these income growth regressions and many such Barro style studies have confirmed the hypothesis of conditional income convergence (Barro, 1998; Caselli *et al.*, 1996; Tsangarides, 2001).

Given the substantial convergence empirics, there are few studies on the β-convergence of low income/poor countries. One of the early papers on convergence confirmed absolute β-divergence among the poor countries (Baumol, 1986). Temple (1998) has confirmed conditional β-convergence among the poorest quartile of countries for the period 1960-85 utilizing the augmented Solow model. More importantly, the study by Keefer and Knack (1997) has specifically discussed the

role of the rule of law and institutional variables in explaining income convergence among the poor countries. The method utilized in their paper is the same as used in a Barro style growth framework; that is to incorporate the rule of law as a right hand side variable in the convergence regression (Barro, 2003). The resulting conclusions of the paper by Keefer and Knack (1997) endorse the hypothesis of conditional income convergence. The paper was based on cross-section, rather than panel, data. Another important study on the income convergence of poor countries with reference to economic policies is that of Sachs and Warner (1995). These authors concluded that the prevalence of *efficient economic policies* is a crucial determinant of income convergence for poor countries.

This paper analyses conditional β-convergence among low income countries using a dynamic panel data framework for the period 1960-2008. The particular focus in this paper is on the role of the rule of law and/or initial level of human capital in the income convergence of these low income countries. Instead of the usual method of regressing income growth on the rule of law, this paper is utilizing a different approach. The low income countries are separately divided into two further categories, based respectively on the median level of initial human capital stock and median value of the rule of law. Subsequently, conditional income convergence is analyzed in each of the four clusters of low income countries. This approach is expected to furnish comprehensive insights on the income convergence of low income countries in relation to the human capital stock and the rule of law. We are not so much interested in whether the rule of law or human capital impact on growth or long run output per se, but whether they impact on convergence. The important contribution of this paper is that it is the first study on the comparative analysis of

the role of the rule of law and initial human capital stock in the income convergence of poor countries. We further compare these results to those for richer countries.

The paper proceeds with a brief literature review on the role of human capital and rule of law in income growth and convergence in the next section. There then follows a section explaining the methodology of the paper, while section IV discusses the results. The conclusions are presented in the final section.

II. Literature Review

The role of human capital in economic growth has been emphasized primarily by the endogenous growth theory. Lucas (1988) incorporated human capital as one of the variables in the growth model that is expected to help yield increasing returns. The major source of the increasing returns is spillover effects associated with both learning by doing and investment in education and training.[1] Considering the importance of human capital in economic growth, Mankiw *et al*. (1992) have augmented the neoclassical growth model by adding the variable of human capital, and have empirically confirmed its significance. Barro (1991) has also explicitly emphasized the role of initial human capital stock in the income convergence of countries. According to Barro, the convergence of a poor country towards the rich is conditional on the initial level of human capital stocks and these results are confirmed for a sample of 98 world countries. Similarly, in the words of Kyriacou (1991), "*laggard countries cannot converge to the economically more advanced countries unless they have relatively abundant levels of initial human capital*

[1] The significance of human capital had also been highlighted earlier by Uzawa (1965), in the discussion on the relationship between education and economic growth.

stock..... the convergence hypothesis holds true only if sufficient levels of per capita human capital stock have been accumulated". In the context of endogenous growth models, Tamura (1991) has developed a model incorporating spillover effects of human capital in investment technology resulting in income convergence both in levels and growth rates. In this model, human capital convergence is the main source for income convergence.

Another important explanation for the relationship between human capital and income growth is through the channel of *technological diffusion,* because human capital is considered necessary for technological innovations and imitations (Nelson and Phelps, 1966; Apergis, 2009). Baumol (1994) asserted the role of initial human capital for the technological development and hence for the income convergence of countries. Alternatively, the role of research and development in total factor productivity (TFP) growth in a country depends on the threshold level of human capital (Xu, 2000). From a different perspective, human capital is an important determinant of technological spillovers. Aiyar and Feyrer (2002) have not only confirmed that the TFP differences are explaining a key part of income differences across countries but have also validated the vital role of human capital in TFP growth. According to these authors "*international technology spillovers from countries at the frontier to developing countries are facilitated by human capital stock*s".

The literature on the rule of law usually has mainly focused on its relationship with economic growth and development and also on various indicators and measurements of the rule of law (e.g. Haggard *et al*., 2008). As already mentioned, Barro (1991) introduced the rule of law as one of the determinants of income growth in cross-country regressions. According to Barro (1998), better

regulation and the security of property rights is conducive to economic growth of a country through facilitating its investment and trade. Many other studies on cross-country growth and conditional convergence, already mentioned in the introduction, have confirmed the significance of the rule of law and or quality of institutions in this context. Thus Knack and Keefer (1995) found a strong positive correlation between economic growth and the rule of law. They also concluded that '*security of property rights affects not only the magnitude of investment, but also the efficiency with which inputs are allocated'*. According to the results of a study on the estimation of the wealth of nations by the World Bank (2006), the rule of law is the largest component in the *intangible capital* of countries.[2] Finally Anokhin and Schulze (2009) argue that one of the factors limiting innovation is corruption and the ability of the state and market institutions to reliably and impartially enforce the rule of law

III. Methodology and Data

The first step of the analysis is based on the categorizations of world countries into four income groups. A world sample of 98 countries for the period 1960-2008, is categorized into four income groups of high, upper middle, lower middle and low income using the cluster analysis on the data of real per capita income in 1960.[3] The agglomerative form of the hierarchical cluster method is used which is based on

[2] Intangible capital includes human capital, social capital and governance.

[3] It is worth mentioning that utilizing the gross national income (GNI) per capita based on the *Atlas method*, the World Bank database categorizes the countries into four income groups namely low, lower middle, upper middle and the high income groups. However, there is no information available related to this grouping prior to the 1970s either in the World Bank database or in any of the studies pertaining to economic growth and/or income convergence.

Ward's linkage method. Out of a total of 98 countries, 58 countries fall in the category of low income in 1960.[4] The initial year of the sample, 1960, is chosen for classification to avoid the possibility of the *ex-post sample bias* in the income convergence analysis. The primary focus of the convergence analysis in the following is the low income cluster, which also has the highest number (58) of countries. However, we will also be interested in how low income country convergence compares to that of richer countries.

The analysis is based on the estimation of conditional β-convergence for the low income group, and among its various categorizations, using data on per capita income. Conditional income convergence is analyzed utilizing the panel data framework for the augmented Solow model given by Islam (1995). This can be written as:

$$Gy_{it\tau} = f(s_{kit\tau}, h^*_{i\tau}, (n_{it\tau} + g + \delta), y_{it}) \qquad (1)$$

This formulation originally is based on the convergence equation of the augmented Solow model developed by Mankiw *et al*. (1992). In the above equation $Gy_{it\tau}$ denotes the growth rate of per capita income for a panel interval in which $y_{i\tau}$ and y_{it} denote the terminal and initial levels of income in the interval. s_k is the accumulation of physical capital, h^* is the steady state level of human capital and n denotes population growth. g and δ are the technological growth rate and deprecation rate respectively; both of which are assumed to be constant for all the

[4] Data availability for real per capita GDP and other key variables determine the size of the total sample of countries, which equals 98.

countries with a combined value of 5%, as in Mankiw *et al*. (1992) and Islam (1995). This equation additionally includes both the cross-section fixed effects and time fixed effects. The right hand side variables are measured in the natural log form and their respective coefficients are non-linear. The specific form of Equation 1 as in Islam (1995) is:

$$\ln\left[\frac{y_{i\tau}}{y_{it}}\right] = \mu_i + (1-e^{-\beta\xi})\left(\alpha/1-\alpha\right)\ln(s_{k\,it\,\tau}) + (1-e^{-\beta\xi})\left(\eta/1-\alpha\right)\ln(h^{*}_{i\tau})$$
$$-(1-e^{-\beta\xi})\left(\alpha/1-\alpha\right)\ln(n_{it\tau}+g+\delta) - (1-e^{-\beta\xi})\ln(y_{it}) + \delta_t \qquad (2)$$

μ_i and δ_t denote the cross-section fixed effects and time fixed effects respectively. β is the conditional convergence coefficient.

The data for real per capita GDP, population and investment share of GDP (s_k) is taken from the Penn World Table (PWT) 7.0. This panel data is based on five-yearly intervals, and growth rates of GDP per capita are calculated over these five years. The variables of population growth and accumulation of physical capital are non-overlapping averages for each five yearly interval. Since, the income growth rate is a function of the steady state level of human capital in the augmented Solow model; the value of human capital in period τ is used in the estimations. However, instead of considering the series of human capital stock, the variable of human capital per worker is constructed utilizing the Mincerian earnings function: $h_i = e^{\phi(E_i)}$ with ϕ denoting the returns to the education, E. The country specific estimates for returns to education are taken from Psacharopoulos and Patrinos (2004) while the data for average years of schooling of the population age 15 and above, E,

is taken from Barro and Lee (2010). The particular reason for utilizing this method is that it makes use of the micro-economic literature on the Mincerian earnings function and is consistent with a log-linear relationship between human capital and growth (Cohen and Soto, 2007 and Bergheim, 2008). It is worth noting that human capital per worker is typically considered a regressor explaining GDP per worker growth; therefore, the human capital per person is calculated for the per capita growth regressions.

In addition to the above mentioned variables, human capital stock and a rule of law index are also utilized for the further categorizations of the income groups. The data for the rule of law index is sourced from the *Economic Freedom of the World data* by the Fraser Institute. This measure is a component of the Economic freedom of the World index and encompasses legal structure and security of property rights. Data for this variable is only available with a five-yearly frequency. The economic freedom of the world index has been widely used by many researchers including Gwartney *et al*. (2004) and Williamson and Mather (2011). All variables are defined in a data appendix where a full list of countries in the different groupings is provided.

The income growth regressions in Equations 1 and 2 can alternatively be written as:

$$y_{it} = \gamma y_{it-1} + \sum_{j=1}^{k} \beta_j x_{it}^j + \delta_t + \mu_i + \nu_{it} \qquad (3)$$

In this form, explanatory variables and their coefficients are denoted by x_{it}^j and β_j respectively. μ_i represents the cross-sectional fixed effects and δ_t denotes the time

effects. Thus, the augmented Solow model based conditional convergence equation is consistent with a dynamic panel framework and can be estimated using the system GMM technique. This is a better estimator than differenced GMM in the presence of persistent data e.g. GDP per capita and, is also preferred in case of small sample time periods (T), such as T=10 as in this paper (Bond *et al*., 2001). In their separate studies on the bias properties of dynamic panel data estimators, Hayakawa (2007) and Soto (2009) concluded system GMM method to be least biased and most efficient compared to the differenced and level GMM methods.

IV. Results

Initially, the augmented Solow model based conditional β-convergence is estimated for the full sample of low income countries. The results are reported in column 1 of Table 1. According to these results, the coefficient on the accumulation of physical capital ($\ln(s_{k\,it\tau-1})$) is positive and significant, confirming the already well established positive relationship between investment and income growth. Similarly, the variable comprising the sum of population growth, depreciation and technological growth, $n_{it}+g+\delta$, is negative and significant. Contrary to the positive impact of physical capital accumulation, human capital per person ($\ln(h^{*}_{i\tau})$) is having an insignificant impact on income growth of low income countries. This is consistent with the findings of a number of studies which have confirmed the insignificant impact of human capital on income growth (Kumar, 2006; Temple, 1999; Benhabib and Spiegel, 1994). One plausible explanation for the lower size and/or insignificant coefficient on human capital is the relationship between the two

forms of the capital in the growth regressions as put forth by De la Fuente and Domenech (2006), Soto (2002) and Krueger and Lindahl (2001). According to Pritchett (2001), the insignificance of human capital is because of the low quality of education, low returns and/or poor quality of institutions in a country. This explanation may be particularly relevant for low income countries.

[Insert Table 1 about here]

There is no evidence of conditional income convergence for the low income countries with the augmented Solow model as the coefficient on initial income is negative but insignificant in column 1 of Table 1. This result implies that even after controlling for the differences in human capital, physical capital and population growth, the low income countries are not converging towards their steady states. However, although the low income countries as a whole have not indicated any evidence of convergence, an important question is whether any specific sub-sample of low income countries is converging or not. As mentioned in section II, a certain level of human capital stock is considered necessary for technological diffusion and growth according to different studies, while Barro (1991) has emphasized the role of initial human capital for income convergence. We thus divide countries into two on the basis of whether they had above or below average human capital stock in 1960. But in addition, we further classify countries into two on the basis of whether the average rule of law index over the period 1970-2008 (the period for which this data is available) was above or below average. Both of the categorizations are performed independently to assess the relative significance of initial level of human capital

and/or the rule of law in the income convergence of low income countries. In both cases the average is defined by the median.

The list of countries in each of the clusters is given in Table A-1 in an appendix together with the average real per capita income growth of each country over the period 1960-2008. It is evident from the Table A-1 that both the low human capital and poor rule of law countries have had weak average income growth over the last half century. The overall average income growth for these two overlapping groups is around 1%. Moreover, five and six countries, among the low initial human capital cluster and poor rule of law cluster, respectively are characterized by negative average income growth over the study period. It can be inferred from Table A-1, that high initial human capital countries have performed better than the low initial human capital countries, but the highest average income growth pertains to the better rule of law cluster, with a value of 2.5%. In this group, the only country with negative average income growth is Niger.

Conditional income convergence is estimated among each of these four groupings of low income countries namely, low initial human capital, high initial human capital, poor rule of law and better rule of law countries. The results are also reported in Table 1. Again, the coefficient on physical capital is positive and significant in all the estimations while, population growth is insignificant in its impact on income growth for all the four clusters. An interesting finding in Table 1 is the relationship between human capital and income growth, which is positive and insignificant for the two categories based on the initial human capital. However, it is negative and insignificant for the poor rule of law countries but positive and significant for the countries with a better rule of law. For the better rule of law group, the coefficient on human capital is significant and approximately equal to that

of physical capital; confirming the role of both forms of capital in the income growth of these countries. This may indicate that a better rule of law helps enhance the impact of human capital on income growth.

As far as income convergence within these groups is concerned, none of the groups of low income countries in Table 1 are converging except for the better rule of law cluster.[5] The coefficients on initial income are insignificant in all the regressions apart from the better rule of law countries, implying an annual rate of conditional convergence, β, of 2%. This convergence figure results in a half-life of 35 years. It is worth noting from Table A-1 that there are many countries which are part of both the high initial human capital and better rule of law categories. These also include some of the consistently high growing economies in the study sample, such as China (4.4%), Malaysia (4.4%), South Korea (5.5%), Thailand (4.4%) and Taiwan (5.8%). Nonetheless, the high initial human capital category on its own does not show any evidence of conditional β-convergence. This indicates that a better rule of law has a significant role to play in the income convergence of low income countries, and that only countries with a relatively good rule of law are able to attain higher income growth through convergence towards their steady states.

Of course the median is an arbitrary dividing point. But in a sense that is its attraction, the determination of the split is independent of the researcher. An alternative split could be based, e.g., on the arithmetic mean. But where the literature has divided countries into groups it tends to have been done on the basis of the median (Durlauf and Johnson, 1995; Barro and Lee, 1994; Dinopoulos and

[5]Use of an alternative dataset, i.e. ICRG, for the rule of law confirms the findings of Table 1. Based on this categorization, the poor rule of law countries show evidence of conditional *β-divergence* at a rate of 1.5% per annum while, the better rule of law countries are converging at an annual rate of 2%.

Thompson, 2000) or when dividing into more than two countries, quintiles or similar (Krueger and Lindahl, 2001). A division based on the mean is sensitive to extreme values. In the case of the data we have here, using the mean moves six countries from the high human capital group and five from the better rule of law group. However neither changes the results substantially. The high rule of law countries now converge at a faster rate of 3.6% which actually strengthens our conclusions. But, for the high and low human capital countries and for the low rule of law countries, there is still no significant evidence of conditional income convergence. For high human capital countries, the convergence coefficient is sizeable but insignificant, although in that estimation the coefficient on human capital is now positive and significant.

At this point an interesting comparison of the above results for low income group can be made with the convergence results for the remaining sample of 40 countries consisting of high and middle income countries, also based on the same four categories namely, relatively low initial human capital, high initial human capital, poor rule of law and better rule of law as defined by deviations from the median values for this group. Thus, the methodology for the categorizations and analysis of conditional β-convergence is similar to the one reported earlier. The results are reported in Table 2. Focusing on income convergence, the low initial human capital group is converging at a slower rate of 1.8% per annum compared to the 3.2% annual rate for the high initial human capital countries. This implies that initial human capital has a significant role towards facilitating income convergence of high and middle income countries. However, for these countries, the rule of law does not differentiate between rapidly and slowly converging countries. Both the poor rule of law and the better rule of law clusters in Table 2 have almost similar

annual rates of conditional β-convergence, equalling 2.6% and 2.7% respectively. But a good rule of law does facilitate the role of physical capital in these countries, as does to a lesser extent human capital.

[Insert Table 2 about here]

Finally, all the results on income convergence for the different categorizations are summarized in Figure 1. The values in parentheses with each indicator, the initial human capital and the average rule of law, are the median values which are used to divide the respective samples. It is evident that initial levels of human capital stock and average values of rule of law index are quite different in terms of their impact on low income and high and middle income groups. Human capital is more significant in differentiating in terms of convergence for the latter than the former. Whilst rule of law is an important ingredient facilitating convergence in low income countries.[6]

[Insert Figure 1 about here]

V. Conclusions

The paper has contributed to the literature on income convergence by studying the role of the initial level of human capital stock and the rule of law towards the

[6] This sample consists of Benin, Botswana, Cameroon, Cote d'Ivoire, Gambia, Ghana, India, India, Morocco, Niger, Papua New Guinea and Tunisia [see Table A-1]

catching up of poor countries. The low income countries, as a whole, are not conditionally converging, rather only the countries with a better rule of law have converged over the last fifty years. Moreover, initial levels of human capital stock are not contributing towards the income convergence of poor countries. This qualifies the existing literature on the direct and indirect role of human capital in income growth and convergence. The study concludes that at initial levels of development, the rule of law has a more important role to play than the initial human capital stock. Even the impact of human capital and physical capital on income growth is stronger with a better rule of law. But once a country has developed beyond a certain level in terms of income per capita, then initial levels of human capital become more important. In particular in high and upper middle income countries there is stronger convergence with higher initial levels of human capital. For this group, the rule of law does not differentiate between countries in terms of income convergence, although there is evidence that a good rule of law may facilitate the impact of physical capital in these countries. Thus, initial human capital stock is only effective for income convergence once the countries have the better rule of law. In other words, factor inputs like human capital are effectively contributing towards the income convergence only after a country has attained a certain level of rule of law.

To gain access to the growth potential of convergence, poor, low income countries must first have an adequate rule of law, possibly because this presents a framework entrepreneurs can operate in and also because it may encourage investment, including FDI. Without a good rule of law in these countries other constraints such as skill levels are not relevant. Once, however, a certain level of development has been achieved, the rule of law no longer presents a fundamental

obstacle to convergence. There are two possibilities to explain these results. Firstly it might be that a country cannot move into the middle income cluster without an adequate rule of law, i.e. all or at least the great majority of countries in this cluster have the minimum rule of law necessary to capitalise on convergence. In this respect we note that the average rule of law in the high income countries for the 'low' category (5.4) is above that for the 'high' category in the low income countries (5.3). Alternatively it could be that a higher level of GDP per capita compensates for a poor rule of law, by e.g. making the market more attractive to entrepreneurs and thus encouraging investment.

Improvements in the rule of law have characterised many fast growing developing and emerging economies, including China of course. However, China has a different economic system from other countries, particularly in the field of property rights. For example, Rodrick (2004) has argued that rather than emphasising private ownership of land and industrial assets, the Chinese government implemented novel institutional arrangements such as Township and Village Enterprises (TVEs) which were owned by local communities. Qian (2003) has argued that in the specific context of China, property rights were then more secure than they would have been under a private property-rights legal regime. Other researchers have argued that willingness to tolerate fuzzy property rights in the workplace (Upham, 2009) has been important to rapid economic growth. It is important to increase our understanding of this and in particular appreciate that what constitutes 'good' is to an extent context dependent, and exact copies of one format may not be everywhere optimal.

Our analysis suggests that for low income countries an adequate rule of law is critical to growth, possibly because this presents a framework entrepreneurs can

operate in and also because it may encourage investment, including FDI. Of course this does not mean that this is the only ingredient necessary for growth, and in some cases government-led growth has provided a framework entrepreneurs can operate in and encouraged investment. Indeed governments, albeit subject to outside pressures, are important in determining the institutional framework governing the rule of law. But there are many other ways governments can provide such a framework, for example playing a proactive role in the improvements of soft and hard infrastructures, encouragement of industrial clusters, appropriate tax structures, fiscal, monetary, trade and exchange rate policies, etc. (Rodrik, 2004; Harrison and Rodrıguez-Clare, 2010; Bhagwati, 2004). It may be that in some circumstances, a poor rule of law, at least in the initial stages of development, can be compensated for by these other factors and the country prosper.

References

Aiyar, S.S. and Feyrer, J. (2002) A contribution to the empirics of total factor productivity, Dartmouth College Working Paper No. 02-09, Dartmouth College, Dartmouth.

Anokhin, S. and Schulze, W.S. (2009) Entrepreneurship, innovation and corruption, *Journal of Business Venturing*, **24**, 465-76.

Apergis, N. (2009) Technology, human capital and growth: further evidence from threshold cointegration, *Open Economics Journal*, **2**, 80-6.

Barro, R. J. (1991) Economic growth in a cross section of countries, *Quarterly Journal of Economics*,**106**, 407–43.

Barro, R. J. (1998) *Determinants of Economic Growth: A Cross Country Empirical Study*. MIT Press, United States of America.

Barro, R. J. (2003) Determinants of economic growth in a panel of countries, *Annals of Economics and Finance*, **4**, 231–74.

Barro, R.J. and Lee, J-W. (1994) Sources of economic growth, *Carnegie-Rochester Conference Series on Public Policy*, **40**, 1-46.

Barro, R.J. and Lee, J-W. (2010) A new data set of educational attainment in the World, 1950-2010, NBER Working Paper 15902, National Bureau of Economic Research, Cambridge MA.

Barro, R. J. and Sala-i-Martin X. (1990) Economic growth and convergence across the United States, NBER Working Paper 3419, National Bureau of Economic Research, Cambridge MA.

Baumol, W. J. (1986) Productivity growth, convergence, and welfare: what the long-run data show, *American Economic Review*, **76**, 1072–85.

Baumol, W. J. (1994) Multivariate growth patterns: contagion and common forces as possible sources of convergence, in *Convergence of Productivity: Cross-National Studies and Historical Evidence*, W. J. Baumol, R. R. Nelson and E. N. Wolff (Eds.), New York: Oxford University Press, pp. 62-85.

Benhabib, J. and Spiegel, M. M. (1994) The role of human capital in economic development: evidence from aggregate cross-country data, *Journal of Monetary Economics*, **34**, 143-73.

Bergheim, S. (2008) *Long-run Growth Forecasting*, Springer-Verlag, Berlin.

Bhagwati, J. (2004) *In Defense of Globalization*, Oxford University Press, Oxford.

Bond, S., Hoeffler, A. and Temple, J. (2001) GMM estimation of empirical growth models, Discussion Paper No. 3048, Centre for Economic Policy Research (CEPR), London.

Caselli, F., Esquivel, G. and Lefort, F. (1996) Reopening the convergence debate: a new look at cross-country growth empirics, *Journal of Economic Growth*, **1**, 363-89.

Cohen, D. and Soto, M. (2007) Growth and human capital: good data, good results, *Journal of Economic Growth*, **12**, 51-76.

De la Fuente, A. and Domenech, R. (2006) Human capital in growth regression: how much difference does quality data make? *Journal of the European Economic Association*, **4**, 1-36.

Dinopoulos, E. and Thompson, P. (2000) Endogenous growth in a cross-section of countries, *Journal of International Economics*, **51**, 335–62

Dobson, S. and Ramlogan, C. (2002) Convergence and divergence in Latin America, 1970-1998, *Applied Economics*, **34**, 465-70.

Durlauf, S.N. and Johnson, P.A. (1995) Multiple regimes and cross-country behaviour, *Journal of Econometrics*, **10**, 365-84.

Gwartney, J. D. Holcombe, R. G. and Lawson, R. A. *et al.* (2004) Economic freedom, institutional quality and cross-country differences in income and growth, *Cato Journal*, **24**, 205-33.

Haggard, M.S., MacIntyre, M. and Tiede, B. L. (2008) The rule of law and economic development, *Annual Review of Political Science*, **11**, 205-34.

Harrison, A. and Rodrıguez-Clare, A. (2010) Trade, foreign investment, and industrial policy for developing countries, in *Handbook of Economic Growth, Vol. 5*, D. Rodrik (Ed.), North-Holland, Amsterdam, pp. 4039–213.

Hayakawa, K. (2007) Small sample bias properties of the system GMM estimators in dynamic panel data models, *Economics Letters*, **95**, 32-8.

Heston, A., Summers, R. and Aten, B. (2011) Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices, University of Pennsylvania, Philadelphia.

Islam, N. (1995) Growth empirics: a panel data approach, *Quarterly Journal of Economics*, **110**, 1127–70.

Keefer, P. and Knack, S. (1997) Why don't poor countries catch up? a cross national test of an institutional explanation, *Economic Inquiry*, **35**, 590-602.

Knack, S. and Keefer, P. (1995) Institutions and economic performance: cross-country tests using alternative institutional measures, *Economics and Politics*, **7,** 207–27.

Krueger, A. B. and Lindahl, M. (2001) Education for growth: why and for whom? *Journal of Economic Literature*, **39**, 1101-36.
Kumar, C.S. (2006) Human capital and growth empirics, *Journal of Developing Areas*, **40**, 153-79.
Kyriacou, G. (1991) Level and growth effects of human capital, C. V. Starr Center Working Paper No. 91-26, University of New York, New York.
Lucas, R. E., Jr. (1988) On the mechanics of economic development, *Journal of Monetary Economics*, **22**, 3–42.
Mankiw, N. G., Romer, D. and Weil, D. N. (1992) A contribution to the empirics of economic growth, *Quarterly Journal of Economics*, **107**, 407–37.
Murthy, V. N. R. and Ukpolo, V. (1999) A test of the conditional convergence hypothesis: econometric evidence from African countries, *Economic Letters*, **65**, 249-53.
Nelson, R. and Phelps, E. (1966) Investment in humans, technological diffusion, and economic growth, *American Economic Review*, **56**, 69-75.
Pritchett, L. (2001) Where has all the education gone? *World Bank Economic Review*, **15**, 367-91.
Psacharopoulos, G. and Patrinos, H. A. (2004) Returns to investment in education: a further update, *Education Economics*, **12**, 111-34.
Qian, Y. (2003) How reform worked in China, in *In Search of Prosperity: Analytic Narratives of Economic Growth*, D. Rodrik (Ed), Princeton University Press, Princeton, NJ, pp. 297-333.
Rodrik, D. (2004) *Getting Institutions Right. CESifo DICE Report 2/2004*, Ifo Institute for Economic Research, Munich.
Sachs, J.D. and Warner, A. M. (1995) Economic convergence and economic policies, NBER Working Paper No. 5039, National Bureau of Economic Research, Cambridge MA.
Sala-i-Martin, X. (1996) The classical approach to convergence analysis, *Economic Journal*, **106**, 1019-36.
Soto M. (2009) System GMM estimation with a small sample, UFAE and IAE Working Papers 780, Unitat de Fonaments de l'Anàlisi Econòmica (UAB) and Institut d'Anàlisi Econòmica (CSIC), Barcelona.
Soto, M. (2002) Rediscovering education in growth regressions, OECD Development Centre Working Paper 202, OECD Development Centre, Paris.
Tamura, R. (1991) Income convergence in an endogenous growth model. *The Journal of Political Economy*, **99**, 522-40.
Temple, J. (1999) A positive effect of human capital on growth, *Economics Letters*, **65**, pp. 131-4.
Temple, J. R. W. (1998) Robustness tests of the augmented Solow model. *Journal of Applied Econometrics*, **13**, 361-75.
Tsangarides, C. G. (2001) On cross-country growth and convergence: evidence from African and OECD countries, *Journal of African Economies*, **10**, 355-89.
Upham, F. (2009) Chinese property rights and property theory, *Hong Kong Law* Journal, **39**, 613–27.
Uzawa, H. (1965) Optimal technical change in an aggregative model of economic growth, *International Economic Review*, **6**, 8–31.
Xu J. (2000) Multinational enterprises, technology diffusion and host country productivity growth, *Journal of Development Economics*, **62**, 477-93.

Williamson, C. R. and Mathers, R. L. (2011) Economic freedom, culture and growth, *Public Choice*, **148**, 313-335.
World Bank (2006) *Where is the Wealth of Nations? Measuring Capital for the 21st Century*, World Bank, Washington D.C.

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Table 1: Conditional income convergence: augmented Solow model

Low income and categories (1960-2008)

Category	**Full sample Low income**	**Low initial human capital**	**High initial human capital**	**Poor rule of law**	**Better rule of law**
No. of Observations/No. of countries	**580/58**	**290/29**	**290/29**	**280/28**	**300/30**
ln ($Y_{i,t}$)	-0.037	-0.0191	0.013	-0.012	-0.097*
	(1.19)	(0.40)	(0.22)	(0.26)	(2.26)
ln ($s_{k\,it\tau-1}$)	0.164**	0.149**	0.212**	0.168*	0.257**
	(4.76)	(2.76)	(4.00)	(2.55)	(5.16)
ln ($n_{it} + g + \delta$)	-0.286*	-0.039	0.008	0.195	-0.38
	(2.25)	(0.14)	(0.04)	(0.75)	(1.54)
ln ($h^{*}_{i\tau}$)	0.112	0.055	0.13	-0.129	0.238*
	(1.27)	(0.38)	(1.14)	(0.80)	(2.62)
Implied β (annual)	**0.07**	**0.004**	**-0.003**	**0.002**	**0.02***
	(1.17)	**(0.39)**	**(0.22)**	**(0.26)**	**(2.15)**
Half-life (years)	**-**	**-**	**-**	**-**	**35**
AR(2) test (H_0=no autocorrelation)	0.324	0.311	0.916	0.547	0.425
Hansen test (H_0=all instruments are valid)	0.484	0.873	0.499	0.640	0.819
Difference in Hansen Test (GMM for levels) (H_0=exogenous instruments)	0.162	0.901	0.240	0.538	0.765

Notes: (.) denotes the t statistics of the respective coefficients. */** indicates significance at 5%/1% levels respectively. p values are reported for the tests of the AR(2), Hansen and difference in Hansen. Panel data with five yearly intervals over the period 1960-2008 is utilized for the analysis. Implied rate of convergence (β) is estimated using the Delta Method. Time fixed effects included, estimated by system GMM. The half-life is calculated by the formula, H.L.=ln2/β.

Table 2: Conditional income convergence: augmented Solow model

Categories of high and middle income countries (1960-2008)

Category	**Low initial human capital**	**High initial human capital**	**Poor rule of law**	**Better rule of law**
No. of Observations/No. of countries	**200/20**	**200/20**	**200/20**	**200/20**
ln ($Y_{i,t}$)	-0.084**	-0.147*	-0.120**	-0.127*
	(3.13)	(2.71)	(3.05)	(2.74)
ln ($s_{k\,it\tau-1}$)	0.148	0.283**	0.0439	0.244**
	(2.01)	(3.51)	(0.71)	(3.68)
ln ($n_{it} + g + \delta$)	-0.154	-0.244	-0.383**	-0.223
	(1.58)	(1.24)	(2.89)	(1.85)
ln ($h^*_{i\tau}$)	0.015	0.10	-0.012	0.089
	(0.38)	(0.96)	(0.32)	(0.71)
Implied β (annual)	**0.018****	**0.032***	**0.026****	**0.027***
	(3.00)	**(2.50)**	**(2.86)**	**(2.55)**
Half-life (years)	**39**	**22**	**27**	**26**
AR(2) test (H_0=no autocorrelation)	0.119	0.201	0.113	0.476
Hansen test (H_0=all instruments are valid)	0.939	0.194	0.190	0.168
Difference in Hansen Test (GMM for levels) (H_0=exogenous instruments)	0.994	0.942	0.937	0.530

Notes: see Table 1.

Table A-1: Classifications of low income countries and income growth rates

Initial Low Human capital countries		Initial High human capital countries		Countries with poor rule of law		Countries with better rule of law	
Bangladesh	1.1	Bolivia	0.7	Bangladesh	1.1	Benin	0.6
Benin	0.6	Brazil	2.4	Bolivia	0.7	Botswana	6.1
Botswana	6.1	China	4.4	Burundi	0.7	Brazil	2.4
Burundi	0.7	Colombia	2.3	Central African Rep.	-1.1	Cameroon	0.8
Cameroon	0.8	Dominican Rep.	3.0	Colombia	2.3	China	4.4
Central African Rep.	-1.1	Ecuador	1.7	Congo, Dem. Rep.	-3.2	Cote d`Ivoire	0.6
Congo, Dem. Rep.	-3.2	Fiji	1.7	Congo, Republic	1.9	Dominican Republic	3.0
Congo, Republic	1.9	Guatemala	1.5	Ecuador	1.7	Fiji	1.7
Cote d`Ivoire	0.6	Honduras	1.0	Egypt	3.2	Gambia, The	0.8
Egypt	3.2	Jordan	1.1	Guatemala	1.5	Ghana	1.5
Gambia, The	0.8	Kenya	0.3	Haiti	-0.6	India	3.1
Ghana	1.5	Korea, Republic	5.5	Honduras	1.0	Jordan	1.1
Haiti	-0.6	Lesotho	2.5	Indonesia	3.6	Kenya	0.3
India	3.1	Malaysia	4.4	Mali	1.2	Korea, Republic	5.5

						of	
Indonesia	3.6	Mauritania	2.1	Mozambique	1.5	Lesotho	2.5
Malawi	1.2	Mauritius	3.0	Nepal	1.2	Malawi	1.2
Mali	1.2	Namibia	1.4	Nicaragua	-0.3	Malaysia	4.4
Morocco	3.3	Nicaragua	-0.3	Pakistan	2.4	Mauritania	2.1
Mozambique	1.5	Panama	3.2	Paraguay	1.6	Mauritius	3.0
Nepal	1.2	Paraguay	1.6	Philippines	1.7	Morocco	3.3
Niger	-0.3	Philippines	1.7	Rwanda	0.3	Namibia	1.4
Pakistan	2.4	Romania	4.0	Senegal	0.1	Niger	-0.3
Papua New Guinea	2.3	Senegal	0.1	Sierra Leone	0.6	Panama	3.2
						Papua New	
Rwanda	0.3	Sri Lanka	3.4	Sri Lanka	3.4	Guinea	2.3
Sierra Leone	0.6	Taiwan	5.8	Syria	1.9	Romania	4.0
Syria	1.9	Tanzania	1.8	Togo	-0.1	Taiwan	5.8
Togo	-0.1	Thailand	4.4	Uganda	1.1	Tanzania	1.8
Tunisia	2.9	Zambia	0.1	Zimbabwe	-1.5	Thailand	4.4
Uganda	1.1	Zimbabwe	-1.5			Tunisia	2.9
						Zambia	0.1
Average	**1.3**	**Average**	**2.2**	**Average**	**1.0**	**Average**	**2.5**

Note: The two human capital classifications are based on the initial level of human capital stock, 1960. The average value of rule of law index for the period 1960-2008 is considered for the rule of law based groupings of low income countries. The median value of each of the indicator is used as a benchmark for the divisions. The number in front of each country is the percentage income growth rate over the period 1960-2008.

Table A-2: Classifications of high and middle income countries and income growth rates

Initial Low Human capital countries		Initial High human capital countries		Countries with poor rule of law		Countries with better rule of law	
Algeria	0.9	Argentina	1.3	Algeria	0.9	Australia	2.4
Austria	2.7	Australia	2.4	Argentina	1.3	Austria	2.7
Chile	2.5	Barbados	2.4	Barbados	2.4	Belgium	2.6
Costa Rica	1.7	Belgium	2.6	Chile	2.5	Canada	2.2
Cyprus	3.7	Canada	2.2	Costa Rica	1.7	Denmark	2.3
El Salvador	1.4	Denmark	2.3	Cyprus	3.7	Finland	2.8
France	2.4	Finland	2.8	El Salvador	1.4	France	2.4
Hong Kong	5.1	Greece	3.2	Greece	3.2	Hong Kong	5.1
Italy	2.5	Iceland	2.9	Israel	2.7	Iceland	2.9
Jamaica	1.0	Ireland	3.5	Italy	2.5	Ireland	3.5
Mexico	2.1	Israel	2.7	Jamaica	1.0	Japan	3.5
Peru	1.4	Japan	3.5	Mexico	2.1	Luxembourg	3.4
Portugal	3.4	Luxembourg	3.4	Peru	1.4	Netherlands	2.3
Singapore	5.1	Netherlands	2.3	Portugal	3.4	New Zealand	1.5
South Africa	1.5	New Zealand	1.5	South Africa	1.5	Norway	3.0
Spain	3.2	Norway	3.0	Spain	3.2	Singapore	5.1
Trinidad & Tobago	3.3	Sweden	2.1	Trinidad &Tobago	3.3	Sweden	2.1
Turkey	2.4	Switzerland	1.6	Turkey	2.4	Switzerland	1.6
Uruguay	1.7	United Kingdom	2.1	Uruguay	1.7	United Kingdom	2.1
Venezuela	0.8	United States	2.1	Venezuela	0.8	United States	2.1
Average	**2.4**	**Average**	**2.5**	**Average**	**2.2**	**Average**	**2.8**

Note: The two human capital classifications are based on the initial level of human capital stock, 1960. The average value of rule of law index for the period 1960-2008 is considered for the rule of law based groupings of high and middle income countries. The median value of each of the indicator is used as a benchmark for the divisions. The number in front of each country is the percentage income growth rate over the period 1960-2008.

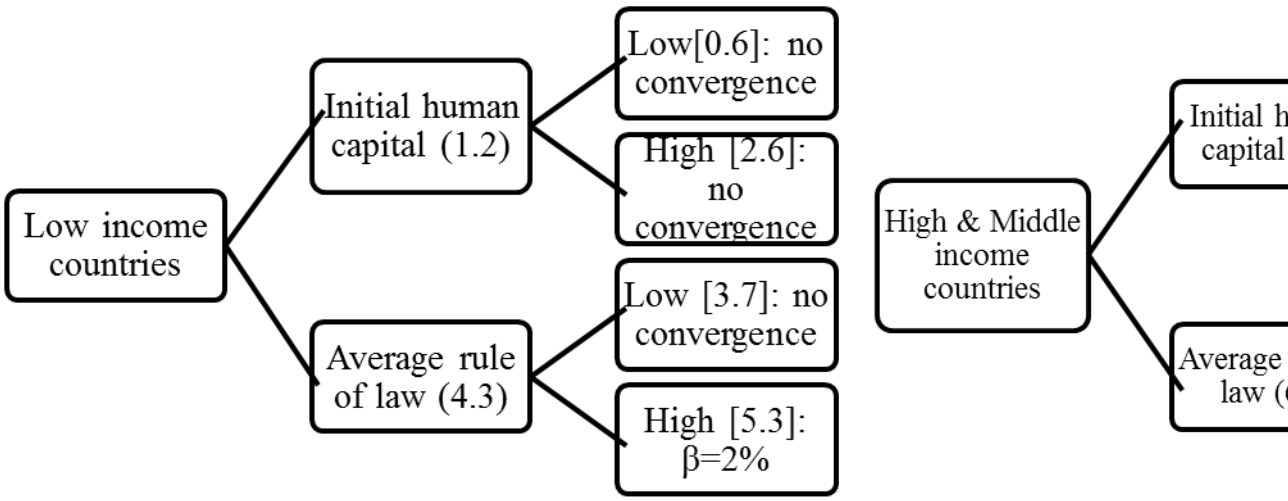

Fig. 1: Summary of the Results

Note: The reported results on income convergence for various categorizations of low income coun
that for the high and middle income countries are derived from Table 2. The categorizations in ea
values of the two indicators namely, initial human capital stock and average rule of law. Thes
parentheses (.). Values in square brackets ([.]) against each category denote the average value of th
or rule of law) for that category.